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VISCOUS FLUID COUPLING

FIELD OF THE INVENTION

The present invention relates to a viscous fluid coupling. It is a coupling used to directly couple an input member to an output member so as to increase the rotating speed of a cooling fan at the output side, when the ambient temperature is high and the motor turns at low speeds.

BACKGROUND OF THE INVENTION

As shown in Fig. 3, as regards a prior art viscous fluid coupling 1, one end of the rotor 2 is fixed. On an output shaft of the motor is a shaft 3 connected by a pulley and a belt. The shaft 3 belongs to an input member 4, on which an output member 6 is supported by a bearing 5 so that the output member 6 can make a relative rotation. A cooling fan is installed within the input member and an case 7 is fixed by a cover plate 8 so that a space is formed within it accordingly. After fixing the external cover 8 to an inner wall, a driving chamber 10 in which the rotor is located is separated from a viscous fluid storing chamber 11 by a baffle plate 9 in the space. A valve 12 facing the baffle plate 9 is installed in the storing chamber 11, with a rod 13 used as a transmission device to connect a radiator to a dual-metal-sheet temperature sensor 14. When the temperature sensor 14 works, the valve 12 can make a control over both the flow and supply of viscous fluids from the storing chamber 11 to the driving chamber 10, no mater whether the communicating pore 15 passing through the baffle plate 9 is open or not. Besides, a pump is designed outside of the cover plate 8 or the baffle plate 9 to drain viscous fluids from the driving chamber 10 to the storing chamber 11. Opposite to the rotor 2 and case 7 are two labyrinths 17, which possess micro-gaps in both axial and radial directions. The labyrinths 17 can exert a shearing stress on the viscous fluid flowing through them, which result in a torque in the input member 4 and output member 6. Besides, when the temperature is low, the valve 12 shall close the communication pore 15. At this time, the storing chamber 11 is unable to supply viscous fluids to the driving chamber 10. Thus, the viscous fluid in the driving chamber 10 is drained to the storing chamber 11 via the pump 16 between the rotor 2 and the case 7, that is to say, the torque transferred between the input member 4 and the output member 6 is small. Thus, the rotating speed of the case 7, namely, the output member 6, can be proportionally expressed by using the quantity of the viscous fluids in the driving chamber 10.

Different from the embodiment shown in Fig. 1, a viscous fluid coupling according to the patent 59-27452 is used, when the rotating speed of the output member is controlled by using a

3-level method.

With regard to the viscous fluids used in prior arts, although the output member and the input member synchronize their speeds, the rotating speed of the input member is generally controlled into a small level. Therefore, when the engine turns at low speeds (for example, the speeds close to idler revolutions), the rotating speed of the output member at the cooling fan side would be low, no matter how high the ambient temperature is, which results in little cooling air for the engine. That is to say, the cooling air is reduced when it is highly demanded.

SUMMARY OF THE INVENTION

The present invention is aimed at solving the various technical issues existing in prior art technologies mentioned above, such as high ambient temperature and low rotating speed of engine, the rotating speed of the output member is increased when the input member is directly coupled with the output member.

In order to solve the varied issues existing in the prior technologies, the present invention combines a viscous fluid coupling with an electromagnetic clutch. The electromagnetic clutch is only energized when the ambient temperature is high and the rotating speed of the input member is low. It is a technical means to directly couple the input member with the output member. In such an occasion, a rotor at the input side and an armature opposite to it are fixed on an output member while a stator and a solenoid coil are fixed on a static device.

Signals of a rotational frequency sensor and a water temperature sensor are pre-determined within a certain range. When an electromagnetic clutch is energized, the armature is connected to the rotor by magnetic forces so that the input member connects directly to the output member. When the ambient temperature is low, or, the rotating speed of the input member is high, the electromagnetic clutch is not energized, and this is what we usually call the mode of power transmissions by viscous fluids.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a sectional view of a viscous fluid coupling used in an embodiment according to the present invention;

Fig. 2 is a curve diagram showing the relationship between the rotating speed of the input member and that of the output member;

Fig. 3 is a sectional view of a viscous fluid coupling used in prior art technologies.

In these figures, “4” represents input member, “6” output member, “20” pulley, “21” rotor, “23” armature, “24” static device, “25” stator, “26” solenoid coil, “27” rotational frequency sensor, “28”water temperature sensor, and “29” relay.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

As shown in Fig. 1, the embodiment according to the present invention is applicable to the viscous fluid with a 3-level output control described in the previously mentioned patent 59-27452. The basic structure and function of the embodiment with a 2-level control shown in Fig. 3 are basically the same as those of the present invention. Therefore, explanations of the parts indicated by the same symbols are omitted.

The pulley 20 is integrated with its opposite rotor 21 as one part. An armature 23 is fixed on an case 7 of the output member 6 by a spring sheet 22 while a stator 25 and a solenoid coil 26 are fixed on the static device 24 facing the rotor.

The solenoid coil 26 can be closed or open in response to a signal from a rotational frequency sensor 27 or a water temperature sensor 28 and it connects to a control circuit including a relay 29.

When the temperature of the engine's coolant is high, the relay at one side is closed in response to a signal from the water temperature sensor 28. When the engine turns at low speeds, the relay at the other side is closed in response to a signal from the rotational frequency sensor 27.Accordingly, the solenoid coil is energized so that the armature 23 and the rotor 21 are connected to each other by magnetic forces, that is to say, the input member 4 and the output member 6 are directly connected to each other. The result is shown by the linear diagram in Fig. 2 that, in comparison with the prior linear expressions when the input member is directly connected to the output member, the rotating speed of the output member 6 should be increased when the engine turns at low speeds.

When the temperature of the engine's coolant is high, the relay at one side is closed in response to a signal from the water temperature sensor 28. When the rotating speed of the motor is increased, the signal from the rotational frequency sensor 27 intermitted and the relay at the other side starts to work. As a result, the solenoid coil 26 is no longer energized. Therefore, the input member 4 and the output member 6 are not directly connected to each other, and this is the mode of power transmissions with viscous fluids used as a medium in common circumstances.

When the temperature of the engine's coolant is low, the signal from the water temperature sensor 28 dies away and the relay at one side starts to work. At this time, due to low rotating speeds of the engine, the signal from the rotational frequency sensor 27 makes the relay at the other side to be closed. Consequently, the solenoid coil 26 is not energized and the result is that the power is transmitted with viscous fluids as the medium as usual. The mode of power transmissions is shown by the linear expression in Fig. 2.

The electromagnetic clutch according to the present invention is only used when the

temperature of the engine's coolant is high and the engine turns at low speeds. In other words, the electromagnetic clutch is only used in the course of low torque transmissions. Before sliding of the clutch, the torque transmission must be completed. Besides, when the electromagnetic clutch is used during low torque transmissions, it can ensure miniaturization and a smooth operation for it. A large size would occupy unnecessary spaces.

CLAIMS

The viscous fluids coupling, wherein an input member includes a rotor and said input member can turn freely by the support of an output member, the rotor is installed in a driving chamber of said output member, a baffle plate is used to separate the driving chamber from a storing chamber holding viscous fluids, a temperature sensor and an operative communication pore are designed for said baffle plate, a valve controlling flow of viscous fluids from said storing chamber to said driving chamber uses the communication pore as a medium, the viscous fluid in the driving chamber is drained through a pump to the storing chamber, the rotor is fixed on the input member, an armatures are located in opposite direction of said rotor, a stator is fixed on a static device, an electromagnetic clutch includes a solenoid coil which is used to control the entire circuit by energizing said electromagnetic clutch when the ambient temperature is higher and the rotating speed of said input member is lower.

ABSTRACT

PURPOSE: To obtain much cooling air by direct-coupling an input member to an output member to increase the rotational frequency of the output member when the ambient temperature is high, and the rev. count of an engine is low. CONSTITUTION: When the temperature of engine cooling water is high, one relay is closed in response to a signal from a water temperature sensor 28. When the rev. count of an engine is low, the other relay is closed in response to a signal from a rotational frequency sensor 27 to apply an electric current to a solenoid coil 26, so that an armature 23 and a rotor 21 are connected to each other by magnetic force. Accordingly, when the engine is rotated at low speed, they are put in the direct-coupled state, and the output member 6 is rotated at high speed to obtain much cooling air.